Name: ______________________________ Date: ________________

LOGARITHM LAWS
ALGEBRA 2 WITH TRIGONOMETRY

Logarithms have properties, just as exponents do, that are important to learn because they allow us to solve a variety of problems where logarithms are involved. Keep in mind that since logarithms give exponents, the laws that govern them should be similar to those that govern exponents. Below is a summary of these laws.

EXPONENT AND LOGARITHM LAWS

LAW	EXPONENT VERSION	LOGARITHM VERSION
Product	$b^x \cdot b^y = b^{x+y}$	$\log_b(x \cdot y) = \log_b x + \log_b y$
Quotient	$\dfrac{b^x}{b^y} = b^{x-y}$	$\log_b\left(\dfrac{x}{y}\right) = \log_b x - \log_b y$
Power	$\left(b^x\right)^y = b^{x \cdot y}$	$\log_b\left(x^y\right) = y \cdot \log_b x$

***Exercise* #1:** Which of the following is equal to $\log_3(9x)$?

(1) $\log_3 2 + \log_3 x$ (3) $2 + \log_3 x$

(2) $2\log_3 x$ (4) $x + \log_3 2$

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***Exercise* #2:** The expression $\log\left(x^2/1000\right)$ can be written in equivalent form as

(1) $2\log x - 3$ (3) $2\log x - 6$

(2) $\log 2x - 3$ (4) $\log 2x - 6$

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***Exercise* #3:** If $a = \log 3$ and $b = \log 2$ then which of the following correctly expresses the value of $\log 12$ in terms of a and b?

(1) $a^2 + b$ (3) $2a + b$

(2) $a + b^2$ (4) $a + 2b$

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***Exercise* #4:** Which of the following is equivalent to $\log_2\left(\sqrt{x}/y^5\right)$?

(1) $\sqrt{\log_2 x} - 5\log_2 y$ (3) $\dfrac{1}{2}\log_2 x - 5\log_2 y$

(2) $2\log_2 x + 5\log_2 y$ (4) $2\log_2 x - 5\log_2 y$

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***Exercise* #5:** The value of $\log_3\left(\sqrt{5}/27\right)$ is equal to

(1) $\frac{\log_3 5-6}{2}$ (3) $\frac{\log_3 5-3}{2}$

(2) $2\log_3 5+3$ (4) $2\log_3 5-3$ ______

***Exercise* #6:** If $f(x)=\log(x)$ and $g(x)=100x^3$ then $f(g(x))=$

(1) $100\log x$ (3) $300\log x$

(2) $6+\log x$ (4) $2+3\log x$ ______

***Exercise* #7:** The expression $\log(\sec x)$ is equivalent to

(1) $-\log(\cos x)$ (3) $\log(\sin x)$

(2) $\log(\tan x)$ (4) $-\log(\sin x)$ ______

***Exercise* #8:** The logarithmic expression $\log_2\sqrt{32x^7}$ can be rewritten as

(1) $\sqrt{\log_2 35x}$ (3) $\sqrt{5+7\log_2 x}$

(2) $\frac{5+7\log_2 x}{2}$ (4) $\frac{35+\log_2 x}{2}$ ______

***Exercise* #9:** The expression $\log_4(y^2-16)-\log_4(y+4)$, assuming $y\neq -4$, can be simplified to

(1) $2\log_4 x-12$ (3) $\log_4(y+4)$

(2) $\log_4(y-4)$ (4) $\log_4 y-1$ ______

***Exercise* #10:** If $\log 7=k$ then $\log(4900)$ can be written in terms of k as

(1) $2(k+1)$ (3) $2(k-3)$

(2) $2k-1$ (4) $2k+1$ ______

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Logarithm Laws
Algebra 2 with Trigonometry - Homework

Skills

1. Which of the following is not equivalent to $\log 36$?

(1) $\log 2 + \log 18$ (3) $\log 30 + \log 6$

(2) $2\log 6$ (4) $\log 4 + \log 9$

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2. The $\log_3 20$ can be written as

(1) $2\log_3 2 + \log_3 5$ (3) $\log_3 15 + \log_3 5$

(2) $2\log_3 10$ (4) $2\log_3 4 + 3\log_3 4$

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3. Which of the following is equivalent to $\log\left(x^3 / \sqrt[3]{y}\right)$?

(1) $\log x - \log y$ (3) $3\log x - \frac{1}{3}\log y$

(2) $9\log(x-y)$ (4) $\log(3x) - \log\left(y/3\right)$

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4. The difference $\log(\cos x) - \log(\sin x)$ can be expressed as

(1) $\log(\sin 2x)$ (3) $\log(\tan x)$

(2) $\log(\cos 2x)$ (4) $\log(\cot x)$

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5. If $\log 5 = p$ and $\log 2 = q$ then $\log 200$ can be written in terms of p and q as

(1) $4p + q$ (3) $2(p+q)$

(2) $2p + 3q$ (4) $3p + 2q$

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6. When rounded to the nearest hundredth, $\log_3 7 = 1.77$. Which of the following represents the value of $\log_3 63$ to the nearest *hundredth*?

(1) 3.54 (3) 3.77

(2) 8.77 (4) 15.93 ________

7. Which of the following is equivalent to $\log(x-6)-\log(x^2-2x-24)$, assuming $x \neq 6$?

(1) $\log(x+4)$ (3) $\log(x+6)$

(2) $\log\left(\frac{1}{x+4}\right)$ (4) $\log\left(\frac{1}{x+6}\right)$ ________

8. The expression $4\log x - \frac{1}{2}\log y + 3\log z$ can be rewritten equivalently as

(1) $\log\left(\frac{x^4 z^3}{\sqrt{y}}\right)$ (3) $\log\left(\frac{x^4 z^3}{2y}\right)$

(2) $\log\left(\frac{6xz}{y}\right)$ (4) $\log\left(\frac{6x^4 z^3}{y}\right)$ ________

9. If $k = \log_2 3$ then $\log_2 48 =$

(1) $2k+3$ (3) $k+8$

(2) $3k+1$ (4) $k+4$ ________

10. If $g(x) = 8x^6$ and $f(x) = \log_4(2x)$ then $f(g(x)) = ?$

(1) $4\log_4 x + 1$ (3) $2(3\log_4 x + 1)$

(2) $3(\log_4 x + 2)$ (4) $6\log_4 x + 4$ ________